In this technological age, mathematics is more important than ever. When students leave school, they are more and more likely to use mathematics in their work and everyday lives — operating computer equipment, planning timelines and schedules, reading and interpreting data, comparing prices, managing personal finances, and completing other problem-solving tasks. What they learn in mathematics and how they learn it will provide an excellent preparation for a challenging and ever-changing future.

The state of Indiana has established the following mathematics standards to make clear to teachers, students, and parents what knowledge, understanding, and skills students should acquire in Grade 3:

Standard 1 — Number Sense

Understanding the number system is the basis of mathematics. Students extend their understanding of the place value system to count, read, and write numbers up to 1,000. They learn to order and round numbers up to 1,000. They develop the concept of equivalent fractions — fractions that look different, but have the same value — and use their understanding of equivalent fractions to compare the sizes of fractions. They also begin to develop the concept of decimals as a different way of representing fractional numbers.

Standard 2 — Computation

Fluency in computation is essential. As students learn about the whole numbers up to 1,000, they learn how to add and subtract them. They develop the concepts of multiplication and division from addition and subtraction and learn basic multiplication and division facts. They also start to add and subtract fractions with the same denominator.

Standard 3 — Algebra and Functions

Algebra is a language of patterns, rules, and symbols. Students at this level represent relationships with numeric equations and use those equations to solve problems. They continue number patterns involving multiplication and use some of the rules for multiplication to check results. They begin to develop the concept of a function and the relationship between numbers and number lines.

Standard 4 — Geometry

Students learn about geometric shapes and develop a sense of space. They identify quadrilaterals and learn about right angles as a basis for comparing other angles. They describe and classify three-dimensional shapes. They use the basic terms point, line, and line segment to describe shapes. They also develop the concept of mirror-image symmetry and draw lines of symmetry.

Standard 5 — Measurement

The study of measurement is essential because of its uses in many aspects of everyday life. Students measure length to the nearest half-inch, add units of length, and find the perimeters of shapes. They estimate area and volume in preparation for developing formulas for calculating them. They estimate, measure, and compare weights, capacities, and temperatures in standard units. They also learn about money: the value of any collection of coins and dollars, writing money using the $ symbol, and deciding whether they have enough money to make a purchase.

Standard 6 — Problem Solving

In a general sense, mathematics is problem solving. In all mathematics, students use problem-solving skills: they choose how to approach a problem, they explain their reasoning, and they check their results. As they develop their skills with numbers, geometry, or measurement, for example, students move from simple ideas to more complex ones by taking logical steps that build a better understanding of mathematics.

As part of their instruction and assessment, students should also develop the following learning skills by Grade 12 that are woven throughout the mathematics standards:

Communication

The ability to read, write, listen, ask questions, think, and communicate about math will develop and deepen students' understanding of mathematical concepts. Students should read text, data, tables, and graphs with comprehension and understanding. Their writing should be detailed and coherent, and they should use correct mathematical vocabulary. Students should write to explain answers, justify mathematical reasoning, and describe problem-solving strategies.

Reasoning and Proof

Mathematics is developed by using known ideas and concepts to develop others. Repeated addition becomes multiplication. Multiplication of numbers less than ten can be extended to numbers less than one hundred and then to the entire number system. Knowing how to find the area of a right triangle extends to all right triangles. Extending patterns, finding even numbers, developing formulas, and proving the Pythagorean Theorem are all examples of mathematical reasoning. Students should learn to observe, generalize, make assumptions from known information, and test their assumptions.

Representation

The language of mathematics is expressed in words, symbols, formulas, equations, graphs, and data displays. The concept of one-fourth may be described as a quarter, ¼, one divided by four, 0.25, ⅛ + ⅛, 25 percent, or an appropriately shaded portion of a pie graph. Higher-level mathematics involves the use of more powerful representations: exponents, logarithms, π, unknowns, statistical representation, algebraic and geometric expressions. Mathematical operations are expressed as representations: +, =, divide, square. Representations are dynamic tools for solving problems and communicating and expressing mathematical ideas and concepts.

Connections

Connecting mathematical concepts includes linking new ideas to related ideas learned previously, helping students to see mathematics as a unified body of knowledge whose concepts build upon each other. Major emphasis should be given to ideas and concepts across mathematical content areas that help students see that mathematics is a web of closely connected ideas (algebra, geometry, the entire number system). Mathematics is also the common language of many other disciplines (science, technology, finance, social science, geography) and students should learn mathematical concepts used in those disciplines. Finally, students should connect their mathematical learning to appropriate real-world contexts.

Standard 1

Number Sense

Students understand the relationships among numbers, quantities, and place value in whole numbers up to 1,000. They understand the relationship among whole numbers, simple fractions, and decimals.*

3.1.1 Count, read, and write whole numbers up to 1,000.

Example: Write 349 for the number "three hundred forty-nine."

3.1.2 Identify and interpret place value in whole numbers up to 1,000.

Example: Understand that the 7 in 479 represents 7 tens or 70.

3.1.3 Use words, models, and expanded form to represent numbers up to 1,000.

Example: Recognize that $492 = 400 + 90 + 2$.

3.1.4 Identify any number up to 1,000 in various combinations of hundreds, tens, and ones.

Example: 325 can be written as 3 hundreds, 2 tens, and 5 ones, or as 2 hundreds, 12 tens, and 5 ones, etc.

3.1.5 Compare whole numbers up to 1,000 and arrange them in numerical order.

Example: What is the smallest whole number you can make using the digits 4, 9, and 1? Use each digit exactly once.

3.1.6 Round numbers less than 1,000 to the nearest ten and the nearest hundred.

Example: Round 548 to the nearest ten.

3.1.7 Identify odd and even numbers up to 1,000 and describe their characteristics.

Example: Find the even number: 47, 106, 357, 629.

3.1.8 Show equivalent fractions* using equal parts.

Example: Draw pictures to show that $\frac{3}{5}$, $\frac{6}{10}$, and $\frac{9}{15}$ are equivalent fractions.

3.1.9 Identify and use correct names for numerators and denominators.

Example: In the fraction $\frac{3}{5}$, name the numerator and denominator.

3.1.10 Given a pair of fractions, decide which is larger or smaller by using objects or pictures.

Example: Is $\frac{3}{4}$ of a medium pizza larger or smaller than $\frac{1}{2}$ of a medium pizza? Explain your answer.

3.1.11 Given a set* of objects or a picture, name and write a decimal to represent tenths and hundredths.

Example: You have a pile of 100 beans and 72 of them are lima beans. Write the decimal that represents lima beans as a part of the whole pile of beans.

3.1.12 Given a decimal for tenths, show it as a fraction using a place-value model.

Example: Shade the part of a square that represents 0.7 and write the number $\frac{7}{10}$.

3.1.13 Interpret data displayed in a circle graph and answer questions about the situation.

Example: Have the students in your class choose the pizza they like best from these choices: cheese, sausage, pepperoni. Use a spreadsheet to enter the number of students who chose each kind and make a circle graph of the data. Determine the most popular and the least popular kind of pizza, and explain what the circle and each pie slice represent.

3.1.14 Identify whether everyday events are certain, likely, unlikely, or impossible.

Example: It is raining in your neighborhood. Is it certain, likely, unlikely, or impossible that the tree in your front yard will get wet?

3.1.15 Record the possible outcomes for a simple probability experiment.

Example: Have a partner toss a coin while you keep a tally of the outcomes. Exchange places with your partner and repeat the experiment. Explain your results to the class.

* whole number: 0, 1, 2, 3, etc.
* equivalent fractions: fractions with the same value (e.g., $\frac{1}{2}$, $\frac{2}{4}$, $\frac{3}{6}$, etc.)
* set: collection of objects, numbers, etc.

Standard 2

Computation

Students solve problems involving addition and subtraction of whole numbers. They model and solve simple problems involving multiplication and division.

3.2.1 Add and subtract whole numbers up to 1,000 with or without regrouping, using relevant properties of the number system.

Example: $854 - 427 = ?$. Explain your method.

3.2.2 Represent the concept of multiplication as repeated addition.

Example: Lynn made 3 baskets each week for 4 weeks. Draw a picture to show how many baskets she made.

3.2.3 Represent the concept of division as repeated subtraction, equal sharing, and forming equal groups.

Example: Bob shared 10 cookies among 5 friends. Draw a picture to show how many cookies each friend got.

3.2.4 Know and use the inverse relationship between multiplication and division facts, such as $6 \times 7 = 42$, $42 \div 7 = 6$, $7 \times 6 = 42$, $42 \div 6 = 7$.

Example: Find other facts related to $8 \times 3 = 24$.

3.2.5 Show mastery of multiplication facts for 2, 5, and 10.

Example: Know the answer to 6×5.

3.2.6 Add and subtract simple fractions with the same denominator.

Example: Add $\frac{3}{8}$ and $\frac{1}{8}$. Explain your answer.

3.2.7 Use estimation to decide whether answers are reasonable in addition and subtraction problems.

Example: Your friend says that $79 - 22 = 27$. Without solving, explain why you think the answer is wrong.

3.2.8 Use mental arithmetic to add or subtract with numbers less than 100.

Example: Subtract 35 from 86 without using pencil and paper.

Standard 3

Algebra and Functions

Students select appropriate symbols, operations, and properties to represent, describe, simplify, and solve simple number and functional relationships.

3.3.1 Represent relationships of quantities in the form of a numeric expression or equation.

Example: Bill's mother gave him money to buy three drinks that cost 45 cents each at the concession stand. When he returned to the bleachers, he gave 25 cents change to his mother. Write an equation to find the amount of money Bill's mother originally gave him.

3.3.2 Solve problems involving numeric equations.

Example: Use your equation from the last example to find the amount of money that Bill's mother gave him, and justify your answer.

3.3.3 Choose appropriate symbols for operations and relations to make a number sentence true.

Example: What symbol is needed to make the number sentence 4 __ 3 = 12 true?

3.3.4 Understand and use the commutative* and associative* properties of multiplication.

Example: Multiply the numbers 7, 2, and 5 in this order. Now multiply them in the order 2, 5, and 7. Which was easier? Why?

3.3.5 Create, describe, and extend number patterns using multiplication.

Example: What is the next number: 3, 6, 12, 24, …? How did you find your answer?

3.3.6 Solve simple problems involving a functional relationship between two quantities.

Example: Ice cream sandwiches cost 20 cents each. Find the costs of 1, 2, 3, 4, … ice cream sandwiches. What pattern do you notice? Continue the pattern to find the cost of enough ice cream sandwiches for the class.

3.3.7 Plot and label whole numbers on a number line up to 10.

Example: Mark the position of 7 on a number line up to 10.

* commutative property: the order when adding or multiplying numbers makes no difference (e.g., 5 + 3 = 3 + 5), but note that this rule is not true for subtraction or division

* associative property: the grouping when adding or multiplying numbers makes no difference (e.g., in 5 + 3 + 2, adding 5 and 3 and then adding 2 is the same as 5 added to 3 + 2), but note that this rule is not true for subtraction or division

Standard 4

Geometry

Students describe and compare the attributes of plane and solid geometric shapes and use their understanding to show relationships and solve problems.

3.4.1 Identify quadrilaterals* as four-sided shapes.

Example: Which of these are quadrilaterals: square, triangle, rectangle?

3.4.2 Identify right angles in shapes and objects and decide whether other angles are greater or less than a right angle.

Example: Identify right angles in your classroom. Open the classroom door until it makes a right angle with one wall and explain what you are doing.

3.4.3 Identify, describe, and classify: cube, sphere*, prism*, pyramid, cone, and cylinder.

Example: Describe the faces of a pyramid and identify its characteristics.

3.4.4 Identify common solid objects that are the parts needed to make a more complex solid object.

Example: Describe and draw a house made from a prism and a pyramid.

3.4.5 Draw a shape that is congruent* to another shape.

Example: Draw a triangle that is congruent to a given triangle. You may use a ruler and pencil or the drawing program on a computer.

3.4.6 Use the terms *point*, *line*, and *line segment* in describing two-dimensional shapes.

Example: Describe the way a triangle is made of points and line segments and how you know it is a triangle.

3.4.7 Draw line segments and lines.

Example: Draw a line segment three inches long.

3.4.8 Identify and draw lines of symmetry in geometric shapes (by hand or using technology).

Example: Use pencil and paper or a drawing program to draw lines of symmetry in a square. Discuss your findings.

3.4.9 Sketch the mirror image reflections of shapes.

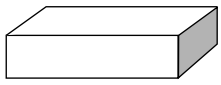
Example: Hold up a cardboard letter F to a mirror. Draw the letter and the shape you see in the mirror.

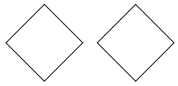
3.4.10 Recognize geometric shapes and their properties in the environment and specify their locations.

Example: Write the letters of the alphabet and draw all the lines of symmetry that you see.

* quadrilateral: a two-dimensional figure with four sides 

* sphere: a shape best described as that of a round ball, such as a baseball, that looks the same when seen from all directions.

* prism: a solid shape with fixed cross-section (a right prism is a solid shape with two parallel faces that are congruent polygons and other faces that are rectangles) 

* congruent: the term to describe two figures that are the same shape and size 

Standard 5

Measurement

Students choose and use appropriate units and measurement tools for length, capacity, weight, temperature, time, and money.

3.5.1 Measure line segments to the nearest half-inch.

Example: Measure the length of a side of a triangle.

3.5.2 Add units of length that may require regrouping of inches to feet or centimeters to meters.

Example: Add the lengths of three sheets of paper. Give your answer in feet and inches.

3.5.3 Find the perimeter of a polygon*.

Example: Find the perimeter of a table in centimeters. Explain your method.

3.5.4 Estimate or find the area of shapes by covering them with squares.

Example: How many square tiles do we need to cover this desk?

3.5.5 Estimate or find the volumes of objects by counting the number of cubes that would fill them.

Example: How many of these cubes will fill the box?

3.5.6 Estimate and measure capacity using quarts, gallons, and liters.

Example: This bottle holds one liter. Estimate how many liters the sink holds.

3.5.7 Estimate and measure weight using pounds and kilograms.

Example: Estimate the weight of your book bag in pounds.

3.5.8 Compare temperatures in Celsius and Fahrenheit.

Example: Measure the room temperature using a thermometer that has both Celsius and Fahrenheit units. If the temperature in the room measures 70°F, will the Celsius measurement be higher or lower?

3.5.9 Tell time to the nearest minute and find how much time has elapsed.

Example: You start a project at 9:10 a.m. and finish the project at 9:42 a.m. How much time has passed?

3.5.10 Find the value of any collection of coins and bills. Write amounts less than a dollar using the ¢ symbol and write larger amounts in decimal notation using the $ symbol.

Example: You have 5 quarters and 2 dollar bills. How much money is that? Write the amount.

3.5.11 Use play or real money to decide whether there is enough money to make a purchase.

Example: You have $5. Can you buy two books that cost $2.15 each? What about three books that cost $1.70 each? Explain how you know.

3.5.12 Carry out simple unit conversions within a measurement system (e.g., centimeters to meters, hours to minutes).

Example: How many minutes are in 3 hours?

* polygon: a two-dimensional shape with straight sides (e.g., triangle, rectangle, pentagon)

Standard 6

Problem Solving

Students make decisions about how to approach problems and communicate their ideas.

3.6.1 Analyze problems by identifying relationships, telling relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.

Example: Solve the problem: "Start with any number. If it is even, halve it. If it is odd, add 1. Do the same with the result and keep doing that. Find what happens by trying different numbers." Try two or three numbers and look for patterns.

3

3.6.2 Decide when and how to break a problem into simpler parts.

Example: In the first example, find what happens to all the numbers up to 10.

Students use strategies, skills, and concepts in finding and communicating solutions to problems.

3.6.3 Apply strategies and results from simpler problems to solve more complex problems.

Example: In the first example, use your results for the numbers up to 10 to find what happens to all the numbers up to 20.

3.6.4 Express solutions clearly and logically by using the appropriate mathematical terms and notation. Support solutions with evidence in both verbal and symbolic work.

Example: In the first example, explain what happens to all the numbers that you tried.

3.6.5 Recognize the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

Example: Measure the length and width of a room to the nearest meter to find how many student desks will fit in it. Would this be an accurate enough method if you were carpeting the room?

3.6.6 Know and use strategies for estimating results of whole-number addition and subtraction.

Example: You buy 2 bags of candy for $1.05 each. The cashier tells you that will be $1.70. Does that surprise you? Why or why not?

3.6.7 Make precise calculations and check the validity of the results in the context of the problem.

Example: In the first example, notice that the result of adding 1 to an odd number is always even. Use this to check your calculations.

Students determine when a solution is complete and reasonable and move beyond a particular problem by generalizing to other situations.

3.6.8 Decide whether a solution is reasonable in the context of the original situation.

Example: In the example about fitting desks into a room, would an answer of 1,000 surprise you?

3.6.9 Note the method of finding the solution and show a conceptual understanding of the method by solving similar problems.

Example: Change the first example so that you multiply odd numbers by 2 or 3 or 4 or 5, before adding 1. Describe the pattern you see.